

processes, and with this remarkable difference ; that while in the latter the cilia propel the water outwards, sending off a current at their apices ; in the tentacula, on the contrary, the cilia are directed downwards, drawing in and sending a current of water down their whole surface. This is exactly what we might be led to expect in the olfactory organs, and forms a beautiful compensation for the power of drawing a current of air through the nostrils in the higher animals. Upon the whole, therefore, we think that little doubt can remain of the real function of these organs.

P.S. Since writing the above, we have seen M. Quatrefages' elaborate paper on his *Eolidina paradoxum* in the 'Annales des Sciences Naturelles,' and are happy to find that many of his observations agree with our own. His *Eolidina* we consider to be undoubtedly an *Eolis* very nearly allied to our *E. angulata*, MS., communicated to the last meeting of the Association.

In the position which he assigns to the anus at the posterior end of the large central vessel of the gastro-vascular system, we conceive him to be under a mistake, deceived probably by the apparently abrupt termination of that vessel. The real anus, we have no doubt, will be found at the side, as in other species of this and the allied genera.

He appears also to have misunderstood the organs of vision, which, it can scarcely be doubted, are as complete as in other species of *Eolis*, as well as in *Polycera*, *Goniodoris* and *Melibæa*, in all of which a lens is distinctly visible ; he however figures and describes the eye in his *Eolidina* as merely a broad convex expansion of the retina and pigmentum nigrum. It would appear from his drawing that he has mistaken the auditory capsule for the optic ganglion or a swelling of the optic nerve, otherwise he has entirely overlooked the organ of hearing. His description of the generative organs is quite at variance with the well-known peculiarities of this order.

M. Quatrefages' remarks on zoological affinities are ingenious : on this interesting portion of the subject however we cannot at present enter, but hope to do so on a future occasion, when a further investigation of the subject shall have enabled us to speak with more certainty than we can possibly do at present.

XXIX.—On the Structure and Affinities of *Upupa*, *Lin.*, and *Irrisor*, *Lesson*. By H. E. STRICKLAND, M.A.*

THE African continent presents us with several species of birds constituting a well-marked genus, to which Lesson in 1831 ap-

* Read to the Zoological Section of the British Association at Cork, August 19, 1843 ; and communicated by the Author.

plied the name *Irrisor*, being a translation of Levaillant's name "*Moqueur*." This group of birds was included by Latham in the genus *Upupa*, by Shaw in *Promerops*, by Vieillot in *Falcinellus*, by Cuvier in *Merops*, and by Temminck and Wagler in *Epimachus*; but as they differ essentially from the types of all these genera, it is necessary to give them a distinct appellation. Mr. Swainson, Mr. Vigors, the Baron de la Fresnaye, and Mr. G. R. Gray restrict to this group the name *Promerops* of Brisson; but Brisson was wholly unacquainted with the group before us, and the true type of his genus *Promerops* is a totally different bird, called by Vieillot *Falcinellus*, and by Swainson *Ptiloturus*. It is plain then that the right course is to supplant *Falcinellus* and *Ptiloturus* in favour of the old generic name *Promerops*, and to adopt for the present group the name *Irrisor* as proposed by M. Lesson.

Having now settled the nomenclature of this group, I will proceed to speak of its affinities, and to show first its relation to the genus *Upupa*; and secondly, its position in the general system of Nature.

It should be premised that the genera *Upupa* and *Irrisor* agree in the form of the beak, but differ in many other particulars. In *Upupa* the plumage is ferruginous, varied with white and black; the head is crested; the tail moderate and even, composed of ten rectrices; the feet adapted for walking; the lateral toes being nearly equal, the exterior ones divided nearly to their base; the anterior claws short and blunt, and the hinder claw lengthened and approaching to straightness. In *Irrisor*, on the contrary, the plumage is black with rich metallic tints, varied only with a few white spots on the wings and tail; the head is not crested; the tail is long and much graduated, composed of twelve rectrices, and the feet are essentially arboreal, the outer toe being much longer than the inner, and united to the middle one for the whole length of the basal joint; the hind toe is very long, and all the claws are compressed, sharp, and much curved. It is evident, therefore, that these birds must differ greatly in their habits; and accordingly we find that the hoopoe lives chiefly on the ground, while the *Irrisor* is described by Levaillant as exclusively inhabiting trees. The question then arises, whether the agreement in the form of their beaks is to preponderate over the disagreements of their other organs; in other words, whether this resemblance in the beaks is to be considered as indicating an affinity or only an analogy.

The majority of authors have classed the *Irrisors* either amongst or very near the Hoopoes. But the Baron de la Fresnaye, in the 'Proc. of the Zool. Soc.' for 1840*, p. 124, contends that the ge-

* See Ann. Nat. Hist., vol. vii. p. 551.—Ed.

nera *Upupa* and *Irrisor* (or as he terms it, *Promerops*,) have in reality no near affinity to each other. He argues that birds have in many cases been arranged artificially in consequence of authors being guided solely by the form of the beak without attending to the structure of the other organs. After pointing out the marked differences between the feet of *Upupa* and those of *Irrisor*, he concludes that *Upupa* has evident affinities with the larks (*Alaudinæ*), but that its true position is in a special family of the *Tenuirostres*, in conjunction with *Upucerthia* and some other allied S. American genera. The genus *Irrisor*, on the contrary, he considers to belong to the *Cinnyridæ*, or as they are more correctly called, *Nectariniidæ*, to which they have much resemblance in their glossy plumage.

Now it is undoubtedly true that the most unnatural classifications of birds have in many cases resulted from the beak being taken as the sole ground of arrangement, to the exclusion of the other organs. I do not however think that the juxtaposition of *Upupa* and *Irrisor* is really an instance of such a vicious arrangement, and I hope to show, that notwithstanding the disagreements in their feet, tail and plumage, these two genera are in reality very closely allied.

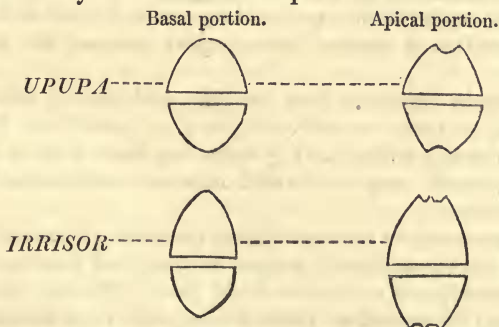
It will generally be found that when several genera of remote affinity have been brought together in consequence of a resemblance in the form of their beaks, that resemblance is more apparent than real, consisting in a general and superficial agreement in the form and outline, while the minor details of structure present differences which at once indicate the true affinities of the respective groups. Thus the genus *Scythrops* was till very lately classed by all authors among the toucans, on account of the general resemblance of the beak, while if the slightest attention had been paid to the position of the nostrils, it would have been seen at once that its true place is among the cuckoos. A similar superficial resemblance in the beak has caused *Tichodroma* to be classed with *Certhia* instead of with *Sitta*, *Spermophila* with *Pyrhula* instead of with *Guiraca*, *Oreoica* and *Falcunculus* among the *Laniinæ* instead of the *Parinæ*, and numerous other cases which might be quoted.

On comparing *Upupa* with *Irrisor*, however, we find a coincidence of structure not only in the general forms, but in the minutest details of the structure of their beaks; and what is of still greater importance, the beaks of these two birds present certain characters which are found in no other group of birds with which I am acquainted.

Upupa and *Irrisor* both present to us the remarkable combination of a very long beak with a very short tongue. The two mandibles are for three-quarters of their length perfectly solid, the surfaces of contact being smooth and flat; while in all other

long-billed birds the interior of both mandibles is provided with a hollow space for the reception and action of a lengthened tongue, or for the temporary retention of their food. This very remarkable and peculiar structure has been noticed by no author (as far I am aware) except Wagler, who in his definitions of *Upupa* and *Epimachus*, in which last genus he includes *Irrisor*, notices this character, but without making any comment on its singularity. It is sufficiently evident from this structure that both *Upupa* and *Irrisor* have very little affinity to the *Tenuirostres*, in which the tongue is remarkably lengthened and adapted to the purposes of suction, and *Irrisor* cannot therefore be referred to the *Nectariniidæ*, as supposed by the Baron de la Fresnaye. The fact is, that the beaks of these birds are not constructed for suction but for *probing*, i. e. for reaching into deep holes and crevices in quest of the larvæ of insects. We know that the hoopoe obtains its food by inserting its beak into the holes made in the ground by coprophagous insects, and it is probable that the *Irrisor* feeds in a similar manner upon the larvæ which perforate decayed trees.

The beaks of these two genera of birds present another character unnoticed by all previous authors, and, like the former one, believed to be peculiar to these two genera alone. The basal and medial portion of the ridge of both mandibles is obtusely and roundedly carinate, but in proceeding towards the apex, the ridge first becomes flattened, then hollowed, and at last deeply grooved. In the *Irrisor* this flattened portion commences in both mandibles about the middle of the beak, and soon changes into a flat-bottomed groove, which towards the apex is divided into two by a fine intermediate ridge. In *Upupa* the flat space commences about two-thirds of the total length from the base, and wants the intermediate ridge. With these slight differences the beaks of the two birds may be considered as quite identical in structure,



while they differ as before remarked from those of all other known birds. These characters are shown in the above figures, which represent magnified transverse sections of the mandibles.

This peculiar coincidence of structure must, I submit, be considered to indicate something more than mere analogy, and rather to show that *Upupa* and *Irrisor* form two subdivisions of the same superior group; or in other words, that they have more affinity to each other than either of them has to any other group which it may resemble.

Nor are the points of mutual agreement in these two genera wholly confined to the structure of the beak. Considerable as their differences undoubtedly are, yet they are not overpoweringly so. They both nidificate in hollow trees. The wings in both are similarly formed, the quills being much graduated, and the fourth and fifth longest. The differences in the style of colouring are not greater than we often meet with in genera of the same subfamily, while the large patches of white on the remiges and rectrices of *Upupa* have their counterparts on the same feathers of *Irrisor*. The differences in the form of their tails is a character admitted to be only of *generic*, and in some genera only of *specific* importance. The most weighty distinction is undoubtedly to be found in the structure of their feet, but this is not greater than will be found in the feet of many terrestrial genera when compared with the arboreal forms of the same families. If we look at the feet of ground-cuckoos, ground-woodpeckers, ground-parrots, or ground-pigeons, we shall find that in every case these members are specially modified to suit the habits of the bird, yet this modification of the feet does not blind us to the true affinities of the species which exhibit it.

It may be said, that in the present case the evidence of the feet neutralizes that of the beak, and renders it indifferent which way we decide the question. But this is not a correct view of the case, because neither the feet of *Upupa* nor of *Irrisor* present any peculiar and unique structure, such as we see in the beaks of both; they only exhibit a slight modification of the same organs adapted for special modes of life, and such as are to be met with in many other instances of genera belonging to one and the same subfamily.

I conclude, therefore, that the true and natural series of affinities will be most correctly exhibited by preserving *Upupa* and *Irrisor* in juxtaposition, and by including them both in the family *Upupidæ*, which may be divided into two subfamilies, *Upupinæ* and *Irrisorinæ*.

We now come to a more difficult question, viz. what is the position of the *Upupidæ* with respect to the other families of birds? They certainly are a very insulated group, forming what in geology would be termed a *remote outlier*, and it is not easy to say to which of the more continental masses they most nearly approximate. Guided by the elongation of the beak, the majority of authors have placed them unhesitatingly among the *Tenuirostres*

